

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (currently amended) A device for automated composite lamination on a mandrel surface of a tool having a rotational axis, comprising:

a mechanical supporting structure, wherein the tool is moveable relative to said mechanical supporting structure; and

5 a plurality of material delivery heads supported by said mechanical supporting structure, wherein:

said mechanical supporting structure provides for movement of said plurality of material delivery heads relative to the mandrel surface; and

10 each of said plurality of material delivery heads is individually positionally adjustable, one relative to another of said plurality of material delivery heads, and relative to the mandrel surface during the automated composite lamination process; and

15 a computer numeric control (CNC) connected to all of said plurality of material delivery heads that operates each material delivery head at a utilization factor that increases delivery of composite material disproportionately for the number of material delivery heads in said plurality over that of a single material delivery head automated composite lamination device.

2. (original) The device of claim 1, wherein said mechanical supporting structure comprises a ring surrounding said mandrel surface and said device further comprises a ring cradle, wherein:

5                    said ring cradle supports said ring, and  
                     said ring cradle moves along the direction of the rotational axis of  
the tool.

3.        (original)     The device of claim 1, further comprising:  
                     an arm mechanism connecting said at least one material delivery  
head to said mechanical supporting structure and providing motion of said at  
least one material delivery head relative to the mandrel surface.

4.        (original)     The device of claim 1, further comprising:  
                     a tail stock that holds the tool and provides for rotation of the tool  
about the rotational axis of the tool.

5.        (original)     The device of claim 1, wherein at least one of said  
plurality of material delivery heads is based on a flat tape laying delivery head.

6.        (original)     The device of claim 1, wherein at least one of said  
plurality of material delivery heads is based on a contour tape laying delivery  
head.

7.        (original)     The device of claim 1, wherein said mechanical  
supporting structure comprises a ring surrounding said mandrel surface, said  
ring connected to at least one vertical support post.

8.        (original)     The device of claim 1, further comprising a horizontal  
turntable that supports the tool so that the rotational axis of the tool is vertical.

9.        (original)     The device of claim 1, further comprising at least one  
creel system mounted on said mechanical supporting structure, wherein said

creel system provides material to at least one of said plurality of material delivery heads.

10. (original) The device of claim 1, wherein at least one of said plurality of material delivery heads is a fiber placement head.

11. (currently amended) A device for automated composite lamination on a mandrel surface of a tool having an axis, comprising:

a mechanical supporting structure, wherein the tool is moveable and rotatable relative to said mechanical supporting structure; and

5 a plurality of material delivery heads supported by said mechanical supporting structure; and

a computer numerical control connected to said plurality of material delivery heads, wherein:

10 said mechanical supporting structure provides for axial translation of said plurality of material delivery heads simultaneously relative to the mandrel surface; and

in operation, each one of said plurality of material delivery heads is positionally adjustable individually relative to all other of said plurality of material delivery heads; and

15 said computer numerical control operates each material delivery head at a speed that increases a machine utilization factor of said device disproportionately to the number of said plurality of material delivery heads compared to a single head so that said device lays down at least 700 pounds per hour (lbs/hr) of composite material at peak rate.

12. (original) The device of claim 11, wherein said mechanical supporting structure comprises a ring surrounding said mandrel surface, and said device further comprises a ring cradle, wherein:

5                   said ring cradle supports said ring in a vertical orientation, and  
                  said ring cradle moves along the direction of the axis of the tool to  
provide said axial translation of said plurality of material delivery heads  
simultaneously relative to the mandrel surface.

13.   (original)   The device of claim 11, further comprising:  
                  an arm mechanism connecting said at least one material delivery  
head to said mechanical supporting structure, wherein:  
                  said arm mechanism provides motion of said at least one material  
5 delivery head relative to the mandrel surface; and  
                  said arm mechanism provides an axial position adjustment of said  
at least one material delivery head relative to the mandrel surface.

14.   (original)   The device of claim 11, further comprising:  
                  a tail stock that holds the tool so that the axis of the tool is  
horizontal and provides for horizontal rotation of the tool about the axis.

15.   (original)   The device of claim 11, wherein at least one of said  
plurality of material delivery heads is chosen from the group consisting of: flat  
tape laying delivery head, contour tape laying delivery head, fiber placement  
delivery head.

16.   (original)   The device of claim 11, further comprising a  
horizontal turntable and wherein:  
                  said mechanical supporting structure comprises a ring surrounding  
said mandrel surface,  
5                   said ring is connected to a vertical support post that provides  
vertical movement of said ring, and  
                  said horizontal turntable supports the tool so that the axis of the

tool is vertical.

17. (original) The device of claim 11, further comprising at least one creel system mounted on said mechanical supporting structure, wherein said creel system provides material to at least one of said plurality of material delivery heads and said at least one of said plurality of material delivery heads  
5 is a fiber placement head.

18. (original) The device of claim 11, wherein said plurality of material delivery heads is simultaneously controllable.

19. (currently amended) A device for automated composite lamination on a mandrel surface of a tool having a rotational axis, comprising:

a mechanical supporting structure, wherein the tool is moveable and rotatable relative to said mechanical supporting structure; and

5 a plurality of material delivery heads supported by said mechanical supporting structure and disposed surrounding the tool;

a numerical control, wherein:

said mechanical supporting structure provides for axial translation of said plurality of material delivery heads simultaneously relative to the mandrel  
10 surface; and

each of said plurality of material delivery heads is individually adjustable with regard to its position relative to every other of said plurality of material delivery heads and relative to said mechanical supporting structure;  
and

15 said numerical control operates each head at a speed, material width, and material weight that increases a composite material delivery rate of said device disproportionately to the number of said plurality of material delivery heads so that said device lays down at least 700 pounds per hour (lbs/hr) of

composite material at peak rate.

20. (original) The device of claim 19, further comprising:  
an arm mechanism connecting said at least one material delivery  
head to said mechanical supporting structure, wherein:

5 said arm mechanism provides motion of said at least one material  
delivery head relative to the mandrel surface in a direction normal to the  
mandrel surface;

said arm mechanism provides rotation of said at least one material  
delivery head relative to the mandrel surface about an axis normal to the  
mandrel surface;

10 said arm mechanism provides a circumferential position  
adjustment of said at least one material delivery head in a hoop direction  
relative to the mandrel surface; and

said arm mechanism provides an axial position adjustment of said  
at least one material delivery head relative to the mandrel surface.

21. (original) The device of claim 19, wherein said mechanical  
supporting structure comprises a ring surrounding said mandrel surface, and  
said device further comprises:

5 a tail stock that holds the tool so that the rotational axis of the tool  
is horizontal and provides for horizontal rotation of the tool; and

a ring cradle, wherein:

said ring cradle supports said ring in a vertical orientation,

10 said ring cradle moves along the direction of the rotational  
axis of the tool to provide said axial translation of said plurality of material  
delivery heads simultaneously relative to the mandrel surface,

at least one of said plurality of material delivery heads is a  
tape laying delivery head; and

said plurality of material delivery heads is capable of laying down at least 700 lbs/hr of composite material.

22. (original) The device of claim 19, further comprising a horizontal turntable and at least one creel system, wherein:

said horizontal turntable supports the tool so that the rotational axis of the tool is vertical and rotates the tool about the rotational axis of the tool,

said mechanical supporting structure comprises a ring oriented horizontally and surrounding said mandrel surface,

said ring is connected to at least one vertical support post that provides vertical movement of said ring,

said at least one creel system is mounted on said ring,

said creel system provides material to at least one of said plurality of material delivery heads,

said at least one of said plurality of material delivery heads is a fiber placement head, and

said plurality of material delivery heads is capable of laying down at least 300 lbs/hr of composite material.

23. (original) The device of claim 19, wherein each of said plurality of material delivery heads is individually controllable in coordination with said plurality of material delivery heads and in coordination with rotation of the mandrel surface of the tool.

24. (currently amended) An aircraft part manufacturing device for automated composite lamination on a mandrel surface of a tool having a rotational axis, comprising:

a mechanical supporting structure, wherein the tool is moveable

5 and rotatable relative to said mechanical supporting structure; and  
a plurality number of material delivery heads supported by said  
mechanical supporting structure and disposed surrounding the tool, wherein,  
during automated composite lamination:

said mechanical supporting structure provides for axial  
10 translation of said plurality of material delivery heads relative to the mandrel  
surface; and

each of said plurality of material delivery heads is  
individually adjustable in position and orientation relative to every other of said  
plurality of material delivery heads and relative to said mechanical supporting  
15 structure; and

a distinct arm mechanism corresponding and connecting each of  
said plurality of material delivery heads to said mechanical supporting structure,  
wherein:

each said arm mechanism provides individual motion,  
20 independently of all other arm mechanisms, of said corresponding material  
delivery head relative to the mandrel surface in a direction normal to the  
mandrel surface;

each said arm mechanism provides individual rotation,  
independently of all other arm mechanisms, of said corresponding material  
25 delivery head relative to the mandrel surface about an axis normal to the  
mandrel surface;

each said arm mechanism provides an individual  
circumferential position adjustment, independently of all other arm mechanisms,  
of said corresponding material delivery head in a hoop direction relative to the  
30 mandrel surface; and

each said arm mechanism provides an individual axial  
position adjustment, independently of all other arm mechanisms, of said  
corresponding material delivery head relative to the mandrel surface; and



35        a computer numerical control in communication with each of said  
      plurality of material delivery heads, wherein:  
             said computer numerical control operates each head at a  
      speed, material width, and material weight that increases a utilization factor of  
      each head so that said device operates at a machine utilization factor that  
      increases a composite material delivery rate of said device disproportionately  
40   compared to the increase of the number of said plurality of material delivery  
      heads over a single material delivery head so that said device lays down at  
      least 700 pounds per hour (lbs/hr) of composite material at peak rate.

25.    (currently amended) An aircraft part manufacturing device for  
automated composite lamination on a mandrel surface of a tool having an axis,  
comprising:

             means for supporting a plurality of material delivery heads wherein  
5    the tool is moveable relative to said plurality of material delivery heads;  
             means for providing for movement of said plurality of material  
delivery heads relative to the mandrel surface to cover substantially all of the  
mandrel surface with the composite material; ~~and~~  
             means for providing an individual position adjustment relative to  
10   every other of said plurality of material delivery heads and relative to the  
mandrel surface for each of said plurality of material delivery heads; and  
             means for operating said plurality of material delivery heads at a  
      speed, material width, and material weight so that said device operates at a  
      machine utilization factor that increases a rate of delivery of composite material  
15   disproportionately beyond the increase of the number of material delivery heads  
      of said plurality of material delivery heads over a single material delivery head  
      so that a mandrel having a diameter of least 15 feet is covered with composite  
      material at a peak rate of at least 700 pounds per hour (lbs/hr).

26. (original) The device of claim 25, wherein said means for supporting said plurality of material delivery heads includes means for translating said plurality of material delivery heads in an axial direction relative to said tool.

27. (previously presented) The device of claim 25, wherein said means for providing an individual position adjustment comprises:

means for providing an axial position adjustment independently for each of said material delivery heads relative to the mandrel surface.

28. (previously presented) The device of claim 25, wherein said means for providing an individual position adjustment comprises:

means for providing a circumferential position adjustment independently for each of said material delivery heads in a hoop direction  
5 relative to the mandrel surface.

29. (previously presented) The device of claim 25, wherein said means for providing an individual position adjustment comprises:

means for providing a motion independently for each of said material delivery heads relative to the mandrel surface in a direction normal to  
5 the mandrel surface; and

means for providing a rotation independently for each of said material delivery heads relative to the mandrel surface about an axis normal to the mandrel surface.

30. (previously presented) The device of claim 25, wherein said means for providing an individual position adjustment comprises:

means for individually controlling each of said plurality of material delivery heads in independent coordination with said plurality of material

- 5 delivery heads and independently in coordination with rotation of the mandrel surface of the tool.

31. (currently amended) A method for automated composite lamination on a mandrel surface of a tool having an axis, comprising steps of:

supporting a plurality of material delivery heads wherein the tool is moveable relative to said plurality of material delivery heads;

- 5 providing for movement of said plurality of material delivery heads relative to the mandrel surface; ~~and~~

providing for each of said plurality of material delivery heads an individual position adjustment relative to each other of said plurality of material delivery heads and independently relative to the mandrel surface; and

- 10 operating each material delivery head at a utilization factor so that said device operates at a machine utilization factor that increases a rate of delivery of composite material disproportionately beyond the increase of the number of material delivery heads of said plurality of material delivery heads over a single material delivery head.

32. (original) The method of claim 31, wherein said step of providing for movement of said plurality of material delivery heads comprises:

translating said plurality of material delivery heads simultaneously in an axial direction relative to said tool.

33. (previously presented) The method of claim 31, wherein said step of providing an individual position adjustment comprises:

- 5 providing a circumferential position adjustment independently for each of said material delivery heads in a hoop direction relative to the mandrel surface; and

providing an axial position adjustment independently for each of

said material delivery head relative to the mandrel surface.

34. (previously presented) The method of claim 31, wherein said step of providing an individual position adjustment comprises:

providing a motion independently for each of said material delivery heads relative to the mandrel surface in a direction normal to the mandrel surface;  
5

providing a rotation independently for each of said material delivery heads relative to the mandrel surface about an axis normal to the mandrel surface.

35. (previously presented) The method of claim 31, wherein said step of providing an individual position adjustment comprises:

individually controlling each of said plurality of material delivery heads in independent coordination with said plurality of material delivery heads and independently in coordination with rotation of the mandrel surface of the tool.  
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36. (original) The method of claim 31, further comprising steps of: rotating the tool about a horizontal axis of rotation; and

delivering a composite material from said plurality of material delivery heads, wherein:

at least one of said plurality of material delivery heads is a tape laying machine; and  
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said plurality of material delivery heads lays down at least 700 lbs/hr of composite material at peak rate.

37. (original) The method of claim 31, further comprising steps of: rotating the tool about a horizontal axis of rotation; and

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delivering a composite material from said plurality of material delivery heads, wherein:

at least one of said plurality of material delivery heads is a fiber placement head, and

said plurality of material delivery heads lays down at least 300 lbs/hr of composite material at peak rate.